

wafer, an electrolyte in said apparatus containing an electroplated metal in solution and having a plating parameter B^2 wherein:

$$B^2 = (\rho/\rho_{el}) (R^2/Wd)$$

where ρ and ρ_{el} are the resistivities of said metal to be electroplated and said electrolyte, respectively, R is the radius of said wafer, W is the thickness of the electroplated metal and d is the distance between said wafer and said counter electrode and $B^2 \leq 1$, and a pump to pump said electrolyte upward against said wafer.

Sub B1
20. An electroplating device for wafer metallization as set forth in claim 19, which further comprises a non-conducting porous separator between said wafer and said counter electrode, whereby the ionic resistance of said electrolyte is increased.

21. An electroplating device for wafer metallization as set forth in claim 19 wherein the concentration of said electrolyte in said apparatus is low enough to increase the ionic resistance of said electrolyte to maintain $B^2 \leq 1$.

a1
22. An electroplating device for wafer metallization as set forth in claim 19, wherein leveling agents are in solution with said electrolyte whereby the charge transfer resistance at the metal/electrolyte interface is increased.

B Sub D2
23. An electroplating device for wafer metallization as set forth in claim 19, wherein the diameter of said counter electrode is smaller than the diameter of said wafer. 39 holder

24. An electroplating device for wafer metallization as set forth in claim 19 which further comprises a rotating distributor placed in front of said wafer and submerged in said electrolyte.

Sub B2
25. A device according to claim 24 in which said distributor is formed with holes at an angle to the flow direction whereby electrolyte emerges from said distributor in the form of multiple submerged jets contacting a face of said wafer.

Sub B3 26. An electroplating device for wafer metallization as set forth in claim 19 which further comprises a rotatable distributor in said apparatus placed in front of said wafer, said distributor being formed with holes at an angle to the flow direction, the level of the electrolyte being below the face of the wafer and above said distributor, and means for forcing electrolyte through said distributor in the form of multiple jets contacting the surface of the wafer and causing rotation of said distributor, whereby said jets serve as an ionic path for the passage of current between said wafer and said counter electrode.

B Sub B3 27. An electroplating device for wafer metallization as set forth in claim 19³⁹ which further comprises means for periodically reversing current to remove excess electroplating metal from areas on the wafer where the electroplating is thicker than the average and wherein the total electrical charge passed during the reversed current period is smaller than the total charge passed during the forward current period.

B 28. An electroplating device for wafer metallization as set forth in claim 19³⁹ which further comprises means for applying pulsed current to said pump during the electroplating process.

A (Sub B3) 29. An electroplating device for wafer metallization as set forth in claim 19 wherein said wafer is stationary and which further comprises means for rotating said electroplating apparatus.

B 17 30. An electroplating device for wafer metallization as set forth in claim 19^{14 39} which further comprises means for rotating said wafer^{holder}.

Sub B4 31. An electroplating device for the metallization of wafers for interconnection comprising an electroplating apparatus, electrolyte in said apparatus, a wafer coated with a thin barrier layer and a thin seed layer of the metal to be electroplated, an assembly of contact pegs on an insulating ring masking the circumferential edge of said wafer and pressing against said wafer, insulating sleeves insulating said pegs from said electrolyte, except at the points of contact with the wafer, said contact pegs being spatially distributed over the surface of said wafer to ensure uniform

Sub B4 electroplating of the metal over the entire wafer, and means for feeding electrical current from a contact to the center of the wafer and from a plurality of contact points at said counter electrode.

7 32. An electroplating device for wafer metallization as set forth in claim 31 which further comprises means for rotating said contact pegs assembly and said wafer together.

Sub B5 8 33. An electroplating device for wafer metallization as set forth in claim 31 in which said pump pulses electrolyte upward against said wafer while said wafer is resting on said contact pegs and said insulating ring.

34. An electroplating device for wafer metallization as set forth in claim 31 which further comprises means for rotating said contact peg assembly and said wafer while said electrolyte is pumped upward against said rotating wafer, said wafer being supported so that an active surface is exposed to electrolyte and the opposite side of said wafer is protected from said electrolyte.

AI 10 35. An electroplating device for wafer metallization as set forth in claim 31 which further comprises means for periodically reversing the current to remove excess electroplating metal from areas on the wafer where the electroplating is thicker than the average and wherein the total electrical charge passed during the reversed current period is smaller than the total charge passed during the forward current period.

Sub B6 36. An electroplating device for wafer metallization as set forth in claim 31 in which said pump pulses during the electroplating process.

B 12 37. An electroplating device for wafer metallization as set forth in claim 31 wherein said wafer is stationary and which further comprises means for rotating said ^{reservoir} ~~electroplating apparatus~~.

13 38. An electroplating device for wafer metallization as set forth in claim 31 which further comprises means for rotating said wafer.